

SERVICE OWNERSHIP OF THE PATRIOT MISSILE SYSTEM:
ARMY OR AIR FORCE?

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General Studies

by

Janell E. Eickhoff, MAJ, USA
B.S., United States Military Academy, West Point, New York, 1991

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THESIS APPROVAL PAGE

Name of Candidate: Janell E. Eickhoff

Thesis Title: Service Ownership of the Patriot Missile System: Army or Air Force?

Approved by:

_____, Thesis Committee Chairman
MAJ Matthew T. Phillips, M.B.A.

_____, Member
COL Michael P. Locke, M.S.

_____, Member
MAJ William J. Maxcy, M.A.

_____, Member, Consulting Faculty
LTC Kenneth D. Plowman, Ph.D.

Accepted this 6th day of June 2003 by:

_____, Director, Graduate Degree Programs
Philip J. Brookes, Ph.D.

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ABSTRACT

SERVICE OWNERSHIP OF THE PATRIOT MISSILE SYSTEM: ARMY OR AIR FORCE, by Janell E. Eickhoff, 60 pages.

Today the Army, Navy, Air Force, and Marines intensely compete over technology and a never sufficient defense budget to defend or expand their respective service's roles, missions, and functions. However, independent air, land, and sea operations no longer exist, and joint doctrine dominates the conduct of warfare. The Joint Forces Commander establishes air superiority through integrated offensive and defensive counterair missions to ensure freedom from attack and freedom to attack. Defensive counterair, synonymous with air defense, is designed to destroy or negate enemy aircraft and missiles after launch and is not the primary responsibility of one service but of all four services. Centering on non-littoral joint areas of operation, should the Army's Patriot forces become a part of the Air Force to effectively and efficiently accomplish the defensive counterair mission for the joint forces commander? Focusing on functionality instead of cost the author evaluated Patriot against the Army and the Air Force using the air defense employment principles of mobility, mix, mass, and integration. Until US adversaries can mount a robust simultaneous air and missile attack or the Air Force acquires positioning authority, the Army is the best service to exploit Patriot for the joint forces commander.

PREFACE

The author is currently completing this study while assigned to the Command and General Staff College (CGSC) at Fort Leavenworth, Kansas. Major Eickhoff is an Army Air Defense Artillery Officer with almost twelve years of experience working with the Patriot missile system. She has served in operational assignments with 4th Battalion 1st Air Defense Artillery Regiment in Baumholder, Germany, the 1st Battalion 7th Air Defense Artillery Regiment in Kaiserslautern, Germany, and the 5th Battalion 52nd Air Defense Artillery Regiment at Fort Bliss, Texas.

Transitioning from Hawk to Patriot, Major Eickhoff first began her joint defensive counterair experience when she deployed to Bahrain shortly after the end of DESERT STORM to protect the island country from potential Iraqi tactical ballistic missiles. Following an assignment to Germany, Major Eickhoff commanded Delta Battery, 5th Battalion 52nd Air Defense Artillery Regiment for twenty-eight months. All in all Major Eickhoff has deployed six times to Southwest Asia in support of multiple operations, has participated in three North Atlantic Treaty Organization (NATO) Evaluations, and has taken part in joint exercises, such as Roving Sands and Joint Combat Identification Evaluation and Test (JCIEIT).

Major Eickhoff is a graduate of the Air Defense Artillery Basic and Advanced Course and is a qualified NATO Fire Control Evaluator, Launcher Control Evaluator, Battalion Operations Evaluator, and Team Leader. She holds a bachelor of science degree from the United States Military Academy and is currently completing her master's degree in military art and science from CGSC.

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ACRONYMS

AADC	Area Air Defense Commander
AAMDC	Army Air and Missile Defense Command
ACA	Airspace Control Authority
AFDD	Air Force Doctrine Document
AIRCENT	Air Forces Central Europe
AROC	Army Requirements Oversight Council
AWACS	Airborne Warning and Control System
CINC	Commander in Chief now called Combatant Commander
CM	cruise missile
CORM	Commission on Roles and Mission
CRC	Control and Reporting Center
DAADC	Deputy Area Air Defense Commander
DCA	defensive counterair
ECS	Engagement Control Station
FW	Fixed-wing aircraft
ICBM	intercontinental ballistic missile
ICC	Information and Coordination Central
IRBM	intermediate range ballistic missile
JAOC	Joint Air Operations Center
JCIET	Joint Combat Identification Evaluation and Test
JEZ	Joint Engagement Zone
JFC	Joint Forces Commander
JFACC	Joint Forces Air Component Commander

JFLCC	Joint Forces Land Component Commander
MEADS	Medium Extended Range Air Defense System
MRBM	Medium Range Ballistic Missile
NATO	North Atlantic Treaty Organization
PAC2	Patriot Advanced Capability 2
PAC3	Patriot Advanced Capability 3
PADIL	Patriot Digital Interface Link
RAM	rocket, artillery, and mortar
RW	rotary-wing aircraft
SAM	surface to air missile
SRBM	Short Range Ballistic Missile
TAC EVAL	tactical evaluation
TADIL	tactical digital interface link
TAGS	Theater Air Ground System
TBM	tactical Ballistic Missile
THAAD	Theater High Altitude Air Defense System
TRADOC	Training and Doctrine Command
TTP	techniques, tactics, and procedures
UAV	unmanned aerial vehicle
UCAV	uninhabited aerial combat vehicle
USC	United States Code
US	United States
WMD/E	weapons of mass destruction/effects

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CHAPTER 1

THE LONG STANDING DEBATE OVER ROLES, MISSIONS, AND FUNCTIONS

The ongoing review of military roles, functions, and missions mandated by Congress, generates intense competition among the Army, Navy, Air Force, Marine Corps, to a lesser extent the Coast Guard, and combatant commands, all of whom struggle to establish and/or defend preferred spheres of influence and authority within the US national security apparatus. Emotion often overwhelms logic in highly charged environments. A lack of trust often makes each Service loathe to rely on the others. Contestable responsibilities prompt identical pleas from the contender: Here I am: send me. (1995, p. 1)

*1995 Commission on Roles and Missions of
the Armed Forces*

The use of airpower and control of the air in military operations in the early part of the twentieth century blurred the lines of operational responsibility between the Army and the Navy and sparked the first debate over roles, missions, and functions among the United States (US) Armed Services (Collins 1995, 7). Amazingly, almost a century later the services are still intensely competing over technology and a never sufficient defense budget to defend or expand their respective service's roles, missions, and functions. To understand the debate, however, one must understand how often and who is ultimately responsible for the review of roles, missions, and functions, the definition of each term, and the key legislation that impacts upon it. In accordance with *Title 10, United States Code (USC)*, Section 153(b), the Chairman of the Joint Chiefs of Staff must review roles, missions, and functions of the United States Armed Services at least once every three years. Admiral William J. Crowe, the first Chairman of the Joint Chiefs of staff to conduct such a review, defined roles, missions, and functions of the armed services in terms that are still accepted today.

- **Roles** are broad, enduring purposes of the United States Armed Services and United States Special Operations Command that Congress prescribes statutorily.
- **Functions**, assigned by the President of the United States and the Secretary of Defense, amplify or supplement statutory roles. (Department of Defense Directive 5100.1 contains the Services contemporary functions)
- **Missions** are broad enduring purposes that the President or the Secretary of Defense assigns to Commanders-in-Chief of US combatant commands. (Crowe 1989, Appendix C)

As General Colin Powell succinctly articulated in his 1993 review, “the primary function of the Services and Special Operations Command is to provide forces--each organized, trained, and equipped to perform a role--to be employed by the CINC of a combatant command in the accomplishment of a mission” (I-3).

Title 10, USC; Department of Defense Directive 5100.1, *Functions of the Department of Defense and Its Major Components*; and the *Goldwater-Nichols Department of Defense Reorganization Act of 1986* are three key pieces of legislation which help frame roles, missions, and functions for the Army, Navy, Air Force, and Marines. *Title 10, USC*, defines the current roles for the Army, Navy, Air Force, and Marines. Department of Defense Directive 5100.1 defines contemporary functions for each of the services. *The Goldwater-Nichols Department of Defense Reorganization Act of 1986* strengthened the Chairman of the Joint Chiefs of Staff authority and underscored the importance of joint doctrine, training, and education amongst all the services (Collins 1995, 1). It is no wonder, however, with the emphasis for all services to be “more joint,” the generally defined roles of the Army, Navy, and Air Force in *USC, Title 10*, and the overlapping contemporary functions found between each service in Department of Defense Directive 5100.1, that all four services compete for resources and squabble over the ownership of assets to perform their designated roles, missions, and functions. For

example, *Title 10, USC*, directs all four services to prepare for prompt and sustained combat (Collins 1995, 3). However, to preserve peace and security, *USC, Title 10* only addresses the Air Force and the Army, but treats those roles precisely the same in any areas occupied by the United States whether that area is the United States proper, her territories, commonwealths, or possessions despite significant differences in each area (Collins 195, 5). To carry this example a step further, Air and Missile Defense functions outlined in Department of Defense Directive 5100.1 stipulates that within the United States of America and elsewhere it is the primary responsibility of the Army, the Navy, the Air force, and the Marines (Collins 1995, 11-13).

Air and Missile Defense functions contribute to the control of the air and ultimately air superiority. “Control of the air is a critical enabler for the joint force because it allows US forces both freedom from attack and freedom to attack” (Joint Publication (JP) 3-0 1995, III-32). To ensure freedom from attack and freedom to attack without interference from the third dimension US forces must establish air superiority (JP 1-02 2002, 22). The joint force establishes air superiority through integrated offensive and defensive counterair missions designed to destroy or negate enemy aircraft and missiles both before and after launch (J P3-0, III-32). JP 3-1.2, *Joint Doctrine for Offensive Operations for Countering Air and Missile Threats*, defines offensive counterair operations as “offensive maneuvers to destroy, disrupt, or neutralize enemy aircraft, missiles, launch platforms, and their supporting structures and systems” (2001, I-2). JP 3-01.3, *Joint Doctrine for Defensive Operations for Countering Air and Missile Threats*, defines defensive counterair (DCA) operations as “all defensive measures to detect, identify, intercept, and destroy or negate enemy air and missile forces attempting

to attack or penetrate the friendly air environment” (2001, I-2). So, if air and missile defense is a primary responsibility of all four services, who is ultimately charged with the prioritization, synchronization, and integration of this function on the battlefield? Does there need to be one service proponent that controls all active DCA assets or will techniques, tactics, and procedures developed in a joint environment suffice to effectively and efficiently accomplish the defensive counterair mission?

Purpose

The purpose of this thesis is to answer the question: To effectively and efficiently accomplish the defensive counterair mission for the Joint Force Commander should the Army’s Patriot forces become a part of the Air Force?

Scope

The scope of this thesis will be the integration of the Army’s Patriot system into joint defensive counterair operations at the tactical level.

Limitations

In 1995, the congressionally mandated Commission on Roles and Missions of the Armed Forces (CORM) conducted a comprehensive re-examination that addressed 20 controversial roles and missions topics including theater air and missile defense. The Congress charted the CORM to ascertain whether “cost effective reallocations of responsibility and resources are required to make ends and means meet efficiently as well as effectively” based on current and projected military capability as well as cost (Collins 1995, 2). The CORM report proposes three courses of action on theater air and missile defense: first, all of the Department of Defense share the responsibility, second the Air

Force and the Navy furnish upper tier defense, and third, the Army and Navy furnish lower-tier defense.

Delimitations

Currently, the Missile Defense Agency is the executive agent for all missile systems within the Department of Defense (Locke 2002). As of December 2002, funding for upgrades to the Patriot missile system comes out of the Army budget for fiscal year 03-05, but Congress intervened to give the upgrade money back to the Missile Defense Agency (Locke 2002). Even with a budget supplement from the Missile Defense Agency, and regardless of which service owns the Patriot missile system, a service will incur a cost in billions of dollars to upgrade and maintain the Patriot system, train personnel, and keep up with associated operational tempo cost. Because the criteria pertaining to “cost” can be manipulated to favor one service or the other, the author will not address the issue and will instead focus on roles, functions, and missions.

In today’s operational environment, certain joint force missions do not necessarily happen sequentially within the three levels of warfare. Counterair missions, whether conducted by the Army or the Air Force, happen more often simultaneously across the strategic, operational, and tactical levels of warfare. This thesis, however, will focus primarily on the tactical level of warfare, where the execution of actual joint training, real-world operations, and systems integration among assets occur. The author fully acknowledges, however, strategic and operational decisions impact the tactical level of warfare and will discuss how the doctrinal relationships between the Joint Forces Commander (JFC), the Joint Forces Air Component Commander (JFACC), the Airspace Control Authority (ACA), the Area Air Defense Commander (AADC), the Joint Forces

Land Component Commander (JFLCC), and the Deputy Area Air Defense Commander (DAADC) impact defensive counterair missions.

Furthermore, this thesis will focus solely on Air Force and Army assets of active DCA and not include Navy capabilities except where appropriate because the conclusions of this thesis will apply to all services. Additionally, because Patriot is the only tactical weapon system capable of killing tactical ballistic missiles used primarily outside of the United States, this thesis will not discuss the Army's short-range air defense mission and will focus on theater defensive counterair and not missile defense of the continental United States. Also, even though passive DCA operations play a role in the overall defensive counterair mission, it does not add substance or controversy to the issue of ownership and will not be discussed. Finally, the author will only look out until the year 2020 because analysts are wary to predict the operational environment and threat capabilities with any certainty beyond that date at the time of this paper.

Assumptions

Defensive counterair operations will continue to be relevant on the battlefield in the twenty-first century. Given funding and fielding timelines, future Army and Air Force active DCA weapons systems, such as theater high-altitude air defense, medium extended range air defense system, the F-22, and the airborne laser programs will not be extensively decelerated and will be partially fielded by 2020. Until then, the Patriot system will be the primary Army DCA asset, and the F15 will be the Air Force's primary DCA asset. Future roles, missions, and functions of the armed services reports to Congress will continue to recommend "further study" of the theater air defense controversy and will not specify a single operational proponent because of cost.

Measuring “Effective and Efficient” DCA Operations

The Oxford Desk Dictionary defines the word effective as, “producing the ending result” (1995, 181). Applying that definition to DCA operations, the author defines “effective” as the integration of DCA assets (located in the joint area of operations) into a command, control, communications, computer, intelligence, and reconnaissance network which allows for the massing of effects to destroy or neutralize multiple and various hostile airborne threats while minimizing fratricide.

The dictionary defines the word efficient as, “productive with minimum waste of effort” (Oxford 1995, 181). Applying this definition to DCA operations, the author defines “efficient” as the optimal mix of mobile DCA assets to detect, identify, intercept, and destroy or negate the airborne target which minimizes duplication of effort.

Conclusion

The Army and the Air Force’s feuding over roles, missions, and functions of theater air defense dates back to WWII even prior to the 1947 National Security Act establishing the Air Force as its own service and will undoubtedly continue in the future (Baucom 1992, 11). The Army and the Air Force’s fight over money only intensifies the need for the “right” mix of weapons platforms that can quickly integrate into the airspace control structure, and mass effects against a hostile air threat to assist in achieving air superiority while minimizing fratricide, and can quickly relocate to support the mission or survive future attacks. What follows is a chapter of documented sources which speaks to this conclusion but also uncovers further questions.

CHAPTER 2

LITERATURE REVIEW

When faced with a 20 year threat, the Government responds with a 15 year plan, in a 6 year defense program, managed by 3 year personnel, attempting to develop a 2 year budget, which in reality is funded by a 1 year appropriation, which is typically 4-6 months late, actually finalized over a 3 day weekend, and approved in a 1 hour decision briefing (...and then they start moving the money around)!!!! (2002)

Lieutenant General Richard L. Trefrey

As stated in chapter 1, the Army, Navy, Air Force, and Marines have and will continue to fight over roles, missions, and functions. Is it really a fight over roles, missions, and functions, or is it really a fight over money? Since the invention of military aviation, divergent views on foreign policy between presidential administrations, lessons learned from military forces engaging in combat, the desire to minimize the duplication of new weapons systems that keep increasing in cost, and a never sufficient defense budget continue to be the impetus for senior leaders in the Department of Defense and the Armed Services to wrestle with the contentious issue of how to create and to best control a technologically superior, yet affordable joint force. In 1987, Richard Davis, a historian with the Air Staff History Branch, produced a study that recounted the history of Air Force and Army cooperation since 1907. His study, titled *31 Initiatives: A Study in Army Air Force Cooperation*, culminated with the recommendations of an ad hoc Army-Air Force group aimed at fabricating a new method of mutual force development between the two services, including cross-service budgeting and programming procedures (Davis 1987, V). Then, Air Force Chief of Staff General Charles Gabriel and Army Chief of

Staff General John Wickham mutually agreed to bypass their respective formal service staff structures, which they rationalized, empowered the group to present unfiltered and nonparochial proposals, to come up with ideas on how to increase cooperative battlefield synchronization and integration (Davis 1987, V).

At the time of the Gabriel-Wickham study, the “AirLand Battle” strategy dominated the security environment. America’s most dangerous threat came from the Soviet Union, and the United States developed its forces and doctrine to directly combat the massive amounts of enemy armor and aircraft that would potentially invade Central Europe through the Fulda Gap (Davis 1987, 24-26). The United States military prescribed to a policy of containment and the idea of attacking the enemy’s second and third echelon armor forces before they could affect friendly Allied ground forces (Davis 1987, 26). A massive Soviet military forced the United States military to examine combat in the air and on the ground. As a result, the Air Force focused on fighting second and third echelon enemy forces from the third dimension (the air) while the Army focused on fighting first echelon enemy forces from the second dimension (the ground). Focused solely on their respective missions, the Air Force and the Army failed to coordinate doctrine for integration between the second and third dimensions and agreed to mutually exclusive control and execution of their respective defensive counterair assets (Davis 1987, 40). The *31 Initiatives* presented a potential solution on how to best coordinate a future joint Army-Air Force defensive counterair fight.

Generals Wickham and Gabriel formally approved *The Memorandum of Agreement (MOA) on US Army–US Air Force Joint Force Development Process* dated 22 May 1984 (Davis 1987, 105). The Wickham-Gabriel memorandum of agreement

addressed six initiatives on air defense including area surface-to-air missiles and or air defense fighters, point air defense, initiatives to counter heliborne assault threats, tactical missile threats, identification friend or foe, and ground-based electronic combat against enemy air attacks (Davis 1987, 107-109). Most significant to this thesis was initiative 1: Initiatives on Area Surface-to-Air Missiles/Air Defense Fighters which explicitly stated:

- a. The Air Force will participate in the requirement and development process for follow-on area surface-to-air missile (SAM) systems.
- b. The Air Force will lead a joint net sensitivity analysis to determine the optimum program mix of current area SAMs and air defense fighters.
- c. The Army will lead a joint effort to study the advisability and feasibility of transferring proponentcy for area SAMs from the Army to the Air Force (Davis 1987, 107).

The Memorandum of Agreement on US Army–US Air Force Joint Force Development Process is “the” baseline document which led to the following chronology of congressional legislation and commissions, Department of Defense directives, and Chairman of the Joint Chiefs of Staff reports designed to clarify Army, Navy, Air Force, and Marine responsibilities in an integrated joint force: *The Goldwater-Nichols Department of Defense Reorganization Act of 1986*; Department of Defense Directive 5100.1 dated 25 September 1987; Chairman of the Joint Chiefs of Staff Admiral William Crowe’s 1989 Report to the Secretary of Defense titled *Roles and Functions of the Armed Forces*; Chairman of the Joint Chiefs of Staff General Colin Powell’s follow up *Roles and Functions of the Armed Forces* 1993 report; Congress’s 1995 Commission on Roles and Functions of the Armed Forces (CORM); the 1997 *Quadrennial Defense Review*; and the *Quadrennial Defense Review* dated 30 September 2001 (Hansen, 2002).

Interestingly, by the time Generals Wickham and Gabriel signed the memorandum of agreement in 1984, the Army had already been fielding Patriot

battalions for two years (Redstone 2002, 3). With the probability of Patriot battalions deploying to and eventually proliferating Europe starting in March of 1985, it is no wonder that all Army proponenty studies recommended Patriot remain an Army asset (Redstone 2002, 3). The Air Force also conducted Patriot proponenty studies. For example, a year later in 1986, Major Frank E. Wilson in his report, *A Proponenty Study for the Patriot Missile System*, examined the feasibility of transferring the Army's Patriot system to the Air Force (iii). Major Wilson's study compared the Army's methods of organizing, training, operating, and sustaining the Patriot missile system vice how the Air Force's Air Tactical Command would perform those same functions (Wilson 1986, iii). His report concluded that transfer of the Patriot system from the Army to the Air Force was feasible, but would cost nearly a billion dollars back in 1986. Based strictly on cost, Wilson's Air Force study recommend the Army retain proponenty of the Patriot missile system (Wilson 1986, iii). Sadly, but in line with reality, all Army and Air Force proponenty studies pertaining to the Patriot missile system are based on cost (McMurtrey 2003).

As the armed forces proceed into the twenty-first century an even more critical force development criterion than affordability may be the development of a joint force that is effective and efficient at battlefield coordination, synchronization, and integration. Reinforcing this point, Secretary of Defense Donald Rumsfeld gave a speech at the National Defense University in Washington, D.C., in January 2002, Mr. Rumsfeld stated that one of America's armed force's six key transformational goals was to "use information technology to link up different kinds of US forces so they can fight jointly" (p. 6). Mr. Rumsfeld went on to say that US armed forces must develop "the kinds of

forces and capabilities that can adapt quickly to new challenges and unexpected circumstances of the 21st century” (2002, 2). More specifically, he stated, “We must move away from the old threat based strategy . . . and adopt a new capabilities based approach--one that focuses less on who might threaten us, or where, and more on how we might be threatened” (2002, 5). To further explain this new capabilities-based strategy, Mr. Rumsfeld posited the US should be asking itself the same question found in Fredrick the Great’s Principles of War: “What design would I be forming if I were the enemy?-- and then fashioning our forces as necessary to deter and defeat that threat” (Rumsfeld 2002, 5).

Complete transformation, however, will not necessarily occur overnight or even in the next fifteen years. In the meantime doctrinal differences, stovepiped (incapable of interoperability) weapons systems, and a lack of frequent true joint training amongst the individual services may be impeding the development of an effective, efficient, and affordable joint force. This conclusion brings up the following secondary questions: How do DCA capabilities integrate with one another? What are the current airspace control relationships and techniques, tactics, and procedures? What is the relationship between engagement authority and identification authority?

The Changing Nature of the Operational Environment

It has been twelve years since the end of the Gulf War, and the US, until recently, had entered a period of strategic calm. Despite the turmoil today, the US is still without a peer competitor (The Army’s Training and Doctrine Command (TRADOC) PAM 525-2-60 2002, 1). General Shinseki, the Army Chief of Staff, has tried to create irreversible momentum for the transformation of Army forces around a contemporary operational

environment that is immensely different than the one that instigated the arms race between the United States and the former Soviet Union (TRADOC PAM 525-2-60 2002, 1-2). Consistent with recent Defense Intelligence Agency estimates, TRADOC published TRADOC PAM 525-2-60 (DRAFT), *A View of the Operational Environment and Threat: A View of the World to 2020 and Beyond*. So, what are the current and future air and missile threats out to 2020?

Current strategic and national strategies, coupled with significant demographic, economic, and technological change, have altered critical variables in the contemporary operational environment (TRADOC PAM 525-2-60 2002, 2). Defining characteristics, such as complex terrain and urban environments, autocratically ruled nations with regional agendas, and increased access to high-technological multifunctional weaponry and systems, have forced a wider spectrum of challenges, promoted instability, increased unpredictability, ultimately resulting in a more complex range of operating environments. Future adversaries will seek to asymmetrically exploit real or perceived US weaknesses while selectively attempting to directly counter US strengths conventionally (TRADOC PAM 525-2-60 2002, 2). Emerging aerial threats to future US operations will attempt to deny or delay entry of Army, joint, and multinational forces into theater; perform advanced intelligence, surveillance, and reconnaissance to attack at the time and location of an adversary's choosing; and conduct sophisticated low-altitude ambushes--all with the intent to produce unacceptable casualties and weaken US public will, ultimately permitting an enemy to win through stalemate or actual victory (TRADOC PAM 525-2-60 2002, 4-10). The adversary's means to accomplish these objectives will no longer be limited to strictly "traditional aerial threats," such as tactical ballistic missiles (TBMs),

helicopters, and fixed wing aircraft, but will expand to include the use of terrorism, satellites, cruise missiles (CM), unmanned aerial vehicles (UAVs), uninhabited combat aerial vehicles (UCAVs), precision rockets, artillery and mortar projectiles, intermediate-range ballistic missiles (IRBMs), and intercontinental ballistic missiles (ICBMs), many equipped with weapons of mass destruction/effects (WMD/E) (TRADOC PAM 525-2-60 2002, 8-17). With unparalleled access and availability through the Internet, foreign military sales, or trade shows, any adversary can affordably acquire advanced intelligence, surveillance, reconnaissance, and weaponry to simultaneously attack the US asymmetrically and conventionally in tactical, operational, and strategic environments across the entire spectrum of conflict (TRADOC PAM 525-2-60 2002, 9-10). The adversary's intent and means to execute that intent within the tactical, operational, and strategic levels of warfare are described in the following paragraphs.

At the tactical level of warfare adversaries will employ adaptable strategies to avoid direct confrontation with a technologically superior US force and will seek battle in complex terrain and urban areas (TRADOC PAM 525-2-60 2002, 15-17). Using UAVs or Special Operations Forces for surveillance, adversaries will plan and conduct sophisticated ambushes primarily centered on choke points in restricted terrain to attrite US forces and disrupt operational tempo (TRADOC PAM 525-2-60 2002, 15-17). The enemy will force fast-moving US forces to slow down or stop to clear a minefield and then attack with UCAVs, long-range rockets, artillery, mortars, and standoff helicopters. Adversaries will also draw US forces into urban areas to inflict heavy casualties (TRADOC PAM 525-2-60 2002, 15-17). Capitalizing on inevitable collateral damage and civilian deaths, adversaries will attempt to degrade US public support via a sophisticated

international media campaign designed to cause the withdrawal of US military forces (TRADOC PAM 525-2-60 2002, 17).

At the operational level of warfare, adversaries will attempt to affect coalition formation and cohesion and the establishment of initial staging bases (TRADOC PAM 525-2-60 2002, 12-13). Using multiple antiaccess strategies, adversaries will attempt to prevent or limit and disrupt the employment of US military forces into the area of conflict (TRADOC PAM 525-2-60 2002, 12-13). The enemy will use terrorism and long-range precision strikes with standoff weapons, such as ballistic missiles, cruise missiles, UAVs, UCAVs, large-caliber rockets, and fixed-wing aircraft against entry points, infrastructure, and geopolitical targets as a means to preclude or delay US military operations (TRADOC PAM 525-2-60 2002, 12-13).

At the strategic level of warfare, adversaries will attempt to eliminate the US advantage of surprise and achieve strategic preclusion (TRADOC PAM 525-2-60 2002, 11-12). To eliminate the element of surprise, adversaries will use commercial space-based surveillance and the worldwide media to assist in gathering intelligence on US actions and intent (TRADOC PAM 525-2-60 2002, 1-2 and 11-12). Adversaries will achieve strategic preclusion by deterring US involvement or limiting its scope and intensity. Adversaries will use terrorists, special operations forces, tactical ballistic missiles, cruise missiles, intercontinental ballistic missiles, and manned aircraft with WMD/E warheads to attack the US homeland, power projection platforms, and symbols of US strength (TRADOC PAM 525-2-60 2002, 11-12). As history indicates, terrorists may commandeer commercial airliners, employing them as “manned cruise missiles” to destroy US geopolitical infrastructure, or use other aircraft, such as crop dusters, to

dispense chemical or biological agents in urban and industrial areas, to incite panic and cause mass casualties.

The United States Army Air Defense Artillery School used TRADOC's threat document and a 2002 Rand Study titled, *Army Air and Missile Defense Future Challenges*, to formulate an Army air defense perspective of the operational environment and threat out to the year 2020. The air defense aerial threat perspective of the operational environment is found in a United States Air Defense Artillery School 2002 document titled, *The Air Threat to the Tactical Force: The Need for Organic Air Defense*. The Deputy Chief of Staff, Force Development Office, approved the following threat summary tables that summarize the future air threat out to just a few years short of 2020.

THREAT SUMMARY BY TIMEFRAME (U)			
THREAT SET	2004 – 2008	2008 – 2012	2012 – 2017
MRBM & SRBM	<ul style="list-style-type: none"> - Difficult target: Fast, small RCS > Short Reaction Time - Proliferated: Users/Quantity - SCUD B/C approx 40% but: > newer systems reaching IOC > Improved Munitions - MRBMs Mainly NO DONG & Derivatives - WMD/WME - Limited countermeasures 	<ul style="list-style-type: none"> - Newer systems increase - Countermeasures trends > Maneuver RV, decoys > Early Release Possible > Signature Reduction - WMD/WME - Operational/Tactical Utility Increases 	<ul style="list-style-type: none"> - Newer systems increase - Countermeasures trends > Maneuver RV, decoys > Early Release Possible > Signature Reduction - WMD/WME - Operational/Tactical Utility Increases
Cruise Missiles (LACM)	<ul style="list-style-type: none"> - Difficult target: Small, low RCS, transonic/supersonic, Low Altitude - Proliferation Limited (Users) - Type I/Type II - Conventional: anti-armor, area attack/anti-personnel, counter-bunker/building - WMD/WME - Limited countermeasures 	<ul style="list-style-type: none"> - Proliferation Now Significant > More Users + Quantities & Systems - Type III Enters Mix - Capability vs. Force Enhanced > Precision/smart munitions > More Flexible Employment - Signature Reduction - Countermeasures Limited > Flare/Chaff, EMJ plausible 	<ul style="list-style-type: none"> - Proliferation Continues - Operational Flexibility Grows - Type III Mix Grows but Type II Dominates Mix - Signature Reduction - Countermeasures possible > Limited Proliferation > Reactive Threat
UAVs (Includes UCAV)	<ul style="list-style-type: none"> - Challenging target: > Small, fairly low RCS, Low Velocity - Proliferation Well Underway > RSTA Leading > Attack Types Beginning - Multiple roles/Uses: RSTA, Attack, EMJ, Decoy, Harass, Comm relay - Near-real-time detection & targeting > Sensor/shooter integration 	<ul style="list-style-type: none"> - Limited Signature Reduction - Proliferation Continues - Threat Force Integration Improves > Sensor-Shooter > Strike Asset - Increased Mission Flexibility: Modular Designs/Payloads - Range/Endurance Increasing - Sensor Standoff Increases - Hard Kill :UCAVs Possible > Slow/Low Cost Cruise Missile 	<ul style="list-style-type: none"> - Limited Signature Reduction - Proliferation Continues - Threat Force Integration and Mission Flexibility Improving - UCAVs Maturing & Proliferating - Electro-Optical Countermeasures (EOCM)

Figure 1. Source: Deputy Chief of Staff Programs, Force Development, *Aerial Perspective of the Operational Environment 2004-2017*, slide 1.



THREAT SUMMARY BY TIMEFRAME (U) (CONCLUDED)



THREAT SET	2004 – 2008	2008 – 2012	2012 – 2017
Fixed Wing and Rotary Wing	<ul style="list-style-type: none"> - Fixed Wing - Inventories Decreasing - Key Trends Underway - Multirole > Use of PGM/LACM (standoff) > Some Signature Reduction > Improved Self-Protection - Rotary-Wing - Specialized Attack Systems Declining but Modernizing - Standoff Range Increasing - Night Capability In Force - Terrain Masking/Hovering Profiles Begin Maturing 	<ul style="list-style-type: none"> - Fixed Wing - New/Modernized Systems > Lower Signatures on New Systems > Self-Protection Improvements - Standoff Use Increasing - Rotary-Wing - New/Modernized Attack Systems in Significant Quantities - Increased Standoff Range More Prevalent - Night Capability Improving - Improved Integration: Near Real Time Tactical Updates 	<ul style="list-style-type: none"> - Improvement Trends Continue - Signature Reduction Possible - Better Force Integration > Responsiveness Enhanced > FW better Integrated with Ground
RAM (Including LCRs)	<ul style="list-style-type: none"> - Trending towards increasing flexibility, battlefield mobility, accuracy, & responsiveness > Artillery Delivered High Precision Munitions (APHPM) > Integrated with RSTA/UAV > Precision land nav/gun-laying > Improved, integrated fire control systems > Increased range (40-50km for Cannon, LCR at 180+ km) > SP increasing (shoot – scoot) - Conventional or WMD/WME - LCR: Replace/Supplement SRBM > Proliferation Well Underway > Highly Mobile, Rapid Response > Enhanced Lethality: Less Rounds to Achieve Kill 	<ul style="list-style-type: none"> - Advanced Capabilities Continue to Proliferate > Increased Range (50+ km Possible) > More ADHPM, Users and Inventory > Rapid, Flexible Response > Improving Integration w RSTA - Trending Away From Mass Batteries to Dispersed Elements in Selected Forces - Range plus Lethality (ADHPM) Produces Operational Impact from Element of Tactical Threat Force. - LCR > Increasing flexibility, battlefield mobility, accuracy, & responsiveness > Range Increasing > Proliferating 	<ul style="list-style-type: none"> - Advanced Capabilities Continue to Proliferate - More Users Have Some Capability to use Dispersed Firing Elements - Increasing flexibility, battlefield mobility, accuracy, & responsiveness - LCR > Range Increases Continue

Figure 2. Source: Deputy Chief of Staff Programs, Force Development, *Aerial Perspective of the Operational Environment 2004-2017*, slide 2.

Succinctly put, the days of fighting on a linear contiguous battlefield against a large military are over. Air Force General Ronald Fogelman summed it up best when he said, “The future threats facing the Joint Forces Commander will be even more diverse, more lethal, and more difficult to detect and kill than we face today. And they will include manned and unmanned, stealthy and non-stealthy vehicles, TBMs, and cruise missiles” (Fogelman 1996, 1).

Similarities in Today’s Doctrine and Definitions

Joint Publication (JP) 0-2, *Unified Action Armed Forces*, discusses doctrine and policy for joint command and control and coupled with Joint Publication 1, *Joint Warfare of the Armed Forces of the United States*, serves as the capstone for all US joint doctrine

(JP 0-2 1995, xviii). Joint Publication 3-0, *Doctrine for Joint Operations*, states, “Air superiority is achieved through the counterair mission, which integrates both offensive and defensive operations from all components to counter air and missile threats” (1995, III-30).

The Army, in FM 3-0, *Operations*, does not define the term counterair, but acknowledges that counterair is an Air Force mission. FM 3-0 specifically states that “support from Army forces made available to the Joint Forces Air Component Commander for tasking include army aviation, air defense, military intelligence, and field artillery” (2001, 2-7). The Army’s stance is directly in line with how joint doctrine defines supported and supporting commanders on the battlefield. Joint Pub 3-0, *Doctrine for Joint Operations* and Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms*, defines the supported commander as “the commander who receives assistance from another commander’s force or capabilities, and who is responsible for ensuring that the supporting commander understands the assistance required” and the supporting commander as “the commander who aids, protects, compliments, or sustains another commander’s force, and who is responsible for providing the assistance required by the supported commander” (JP 3-0 1995, 21; and JP 1-02 2002, 420-421). FM 3-0 even directly quotes out of JP 0-2, *Unified Action Armed Forces*, which states,

Unless limited by the establishing directive, the commander of the supported force will have the authority to exercise general direction of the supporting effort. General direction includes the designation and prioritization of targets or objectives, timing and duration of the supporting action, and other instruction necessary for coordination and efficiency. (2001, 2-7)

So in short, the Army commander understands he is the supporting commander for the Air Force counterair mission.

In addition to agreeing on the command relationships of the counterair mission, Army, Air Force, and joint doctrine agree upon the definitions of key terms used to describe the defensive counterair mission. Joint Pub 3-0.1, *Joint Doctrine for Countering Air and Missile Threats*, states, “The purpose of the joint counterair mission is to attain a desired degree of air superiority to allow freedom of action and protect the joint force” (1995, V). JP 1-02 defines air superiority as, “that degree of dominance in the air battle of one force over another which permits the conduct of operations by the former and its related land, sea, and air forces, at a given time and place without prohibitive interference by the opposing force” (2002, 22). Joint, Army, and Air Force doctrine all agree that air superiority is an essential task for decisive military operations. As stated in chapter 1, counterair is broken up into offensive counterair and defensive counterair. Joint, Army, and Air Force doctrine also agree that countering air and missile threats is a key planning consideration critical to the success of establishing air superiority (JP 3-0 1995, 5).

JP 3-01.3 defines defensive counterair as “all defensive measures designed to detect, identify, intercept, and destroy or negate enemy forces attempting to attack or penetrate the friendly air environment (2001, I-2). Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, defines defensive counterair exactly as JP 3-01.3 defines defensive counterair. In AFDD 2-1.1, *Counterair Doctrine*, it states, “The object of DCA is to protect friendly forces and vital interests from enemy air and missile attacks and is synonymous with air defense” (1997, 3). Again, Army, joint, and Air Force doctrine all agree on the definition of air defense and cite it as, “all defensive measures designed to

destroy attacking enemy aircraft and missiles in the Earth's envelop of atmosphere, or to nullify or reduce the effectiveness of such attacks" (JP 1-02 2002 ,14). So in conclusion, joint doctrine, Army doctrine, and Air Force doctrine all agree on counterair mission relationships and the definition of air superiority, counterair, defensive counterair, and air defense. But these agreements also pose further secondary questions: What is the "right" mix of DCA capabilities to perform the defensive counterair mission? Given the predicted aerial threats in 2020, what capabilities will the Army and the Air Force have to counter these threats?

The Need for Joint Interoperability and Joint Training

The armed services use joint publication, *Joint Doctrine Capstone and Keystone Primer*, to link "joint doctrine to the national security strategy and the national military strategy" (2001, 20). This document explicitly explains command relationships and the critical need for joint interoperability and joint training:

The forces, units, and systems of all services must operate together effectively. This effectiveness is achieved in part through interoperability, which includes collective effort to develop and use joint doctrine and joint tactics, techniques, and procedures; the development and use of joint plans; the conduct of joint training; and a materiel development and fielding process that provides materiel that is fully compatible with and complementary to systems of all Services. (Joint Capstone and Keystone Primer 2001, 13)

JP 3-0, *Doctrine for Joint Operations*, highlights, "Joint forces must be integrated . . . to destroy, neutralize, or minimize air and missile threats, both before and after launch" (1995, III-30). AFDD 2-1.7: *Airspace Control in a Combat Zone*, also stresses the need for joint interoperability and echoes the role of the JFC, JFACC, ACA, AADC, and DAADC outlined in joint doctrine in relationship to the counterair mission. Army FM 3-52, *Army Airspace Command and Control in a Combat Zone*, explains the JFC, JFACC,

JFLCC, ACA, AADC, and the DAADC the same as in Air Force and joint doctrine. FM 3-52 also details the Army's procedures to positively and procedurally identify aerial objects in the third dimension. Most importantly, however, FM 3-52 describes the importance of successful integration with the Air Force to effectively control the airspace and reduce fratricide.

Techniques, tactics, and procedures for command and control of the air in a theater of operations are outlined in the 1998 document *TAGS: Multiservice Procedures for the Theater Air-Ground System*. The TAGS document is the overarching publication for all of the services and defines air defense as well as the JFACC, ACA, and AADC relationships in the same way found in all other Army, Air Force, and joint documents. Additionally, the TAGS document states, "Integrated employment of air-to-air and surface-to-air weapon systems through coordinated detection, identification, assessment, interception, and engagement of air and missile threats is necessary to counter enemy attacks" (1998, VII-10). But, how do current Army and Air Force DCA capabilities mass effects against hostile air and missile threats?

The Army's Air Defense Artillery Branch is currently revising two key manuals on how to conduct joint air defense operations and integrate with the Air Force. First is the Army Air and Missile Defense Command's (AAMDC) document, *JAOC and AAMDC Mission TTP*. In this document the AAMDC articulates techniques, tactics, and procedures on how the Army's Air and Missile Defense Command will integrate with the Air Force's Joint Air Operation Center. The Army's Air Defense Artillery School is in the process of updating the second document titled, FM 44-100, *US Army Air and Missile Defense Operations*, which will not be published until the spring of 2004 at the very

earliest. Until 2004, the current FM 44-100 (2002) is valid and clearly articulates the four air defense employment principles of mix, mass, mobility, and integration. Additionally, Air Defense Artillery has published its Army Requirements Oversight Council (AROC)-approved document titled *The United States Army Objective Force Operational and Organizational Concept for Air and Missile Defense*, dated 5 June 2002. In this document the Air Defense Artillery branch changes its mission from “protecting the force and selected geopolitical assets from aerial, missile attack” to “Army and Missile Defense forces, together with joint, multinational, and interagency forces, will dominate, control, and exploit the third dimension of the joint battle space to win across the spectrum of operations” (48). Ironically, the new air defense mission moves away from the Army mission of “to fight and win the country’s wars” closer to the Air Force’s mission of “to defend the nation through the control and exploitation of air and space” (JP 3-33 1998, vi-vii). Exploitation of the air, begs the secondary question: How is mobility an essential quality of exploitation?

Conclusion

In conclusion, the literature review identified several common themes with respect to active defensive counterair. First, the operational environment is “not” the same as it was twenty or even ten years ago. Second, Joint, Air Force, and Army doctrine all agree on key terms and definitions. Lastly, given the operational environment all three communities agree on the critical need for the “right mix” of assets and for joint systems integration and training to mass effects in the air to ensure air superiority. The next chapter will discuss the methodology to research, analyze, and answer questions stated in chapters 1 and 2.

CHAPTER 3

RESEARCH METHODOLOGY

Separate ground, sea, and air warfare is gone forever. If ever again we should be involved in war, we will fight in all elements, with all services, as one single concentrated effort. Peacetime preparatory and organizational activity must conform to this fact.

President Dwight D. Eisenhower, *Operations*

Previously, chapter 1 defined the problem and asked which service, the Army or the Air Force, was better suited to conduct the DCA mission with Patriot. Chapter 2, “The Literature Review,” identified sources for analysis as well as common themes found throughout the multitude of works. Specifically, chapter 2 cited documentation designed to clarify each of the armed service’s responsibilities in an integrated joint force, doctrine on how the services should integrate to effectively and efficiently conduct the defensive counterair mission and sources that explained the changing nature of the operational environment. Chapter 3, therefore, outlines the author’s methodology to answer the secondary questions posed in chapter 2 that are inextricably linked to answering the primary question asked in chapter 1. Based on the four air defense employment principles found in FM 44-100 of mix, mass, mobility, and integration, the author will use the constant comparative method of qualitative analysis to compare Patriot to the Army and the Air Force. The author will award points to the Army and the Air Force for each employment principle to produce a decision matrix. The service with the most points is the better suited service to exploit Patriot for the JFC.

Barney G. Glaser and Anselm L. Strauss, both professors at Columbia University in New York City, describe the constant comparative method of qualitative analysis in

their book, *The Discovery of Grounded Theory: Strategies for Qualitative Research*.

Simply stated, the author will “convert qualitative data into a crudely quantifiable form” so she can “generate a theory” (Glaser 1967, 106). As a strength, the comparative method of qualitative analysis “is designed to aid the analyst who possesses abilities in generating a theory that is integrated, consistent, plausible, close to the data--and at the same time is in a form clear enough to be readily, if only partially, operationalized for testing in quantitative research” (Glaser 1986, 106). As a weakness, however, the comparative method of qualitative analysis is “dependent of the skills and sensitivities of the analyst” (Mauch 1983, 68). In other words, two analysts working independently with the same data will not necessarily come up with the same results (Glaser 1986, 106).

Data Collection

The author will collect data from both primary and secondary sources. Primary sources will include data collected from interviews. “Interviews are conversations with a purpose rather than a formal set of structured questions” (Plowman 1996, 119). The author will interview airmen and soldiers who have extensive knowledge and experience in tactical defensive counterair operations using open ended and unstructured questions.

Strengths of interviewing include getting an individual’s perspective on the topic and the researcher’s ability to gather large amounts of data in a short period of time (Plowman 1996, 138). Some of the weaknesses with interviewing include the interviewee’s personal bias and the potential for dishonesty (Plowman 1996, 122).

To preclude interview bias, the author gave general information on defensive counterair to the participants before the interview. The author described the counterair mission and asked the participants to explain their experiences. After the interview, the

author provided further details to the participants about the purpose of the study and its research questions. Additionally, the author offered to provide a full transcript to the participants for their reference.

Secondary sources are defined as written documentation that define the need for, designate service responsibility of, and explain the framework of theater air and missile defense. Such documents will include general officer reports and initiatives, Congressional commissions, news and journal articles, as well as Army, Air Force, and joint doctrine and techniques, tactics, and procedures. One of the strengths of secondary sources is an explanation of the definitions, relationships, and organizational structure for defensive counterair operations. As a weakness, however, words in documents are open to human interpretation and sometimes described activities do not mirror reality. A particular weakness of joint doctrine is service bias. The joint staff designates a lead service to write a particular joint doctrine manual. For example, in the case of counterair, the Air Force is the lead service writing JP 3-10.3, *Joint Doctrine for Defensive Operations for Countering Air and Missile Threats*. To counter service specific bias on doctrine, the author will also include documentation from a different service than the lead service.

Data Analysis

The author will use the comparative method for data analysis and a decision matrix. James E. Mauch's book *Guide to the Successful Thesis Dissertation* defines the comparative method of analysis as, "studying two or more existing situations in order to determine and explicate their likeness and their differences" (1983, 70). The comparative

method is the best analysis method for this study because the author will compare how the Army and the Air Force utilize defensive counterair employment principles.

Chapters 1 and 2 not only explained the chronology of events and documentation that led to more than one service being responsible for theater air and missile defense but also acknowledged defensive counterair as one of two critical aspects of the overall counterair mission. Also, as previously stated, JP 3-01.3, *Joint Doctrine for Defensive Operations for Countering Air and Missile Threats*, defined DCA as “all defensive measures to detect, identify, intercept, and destroy or negate enemy air and missile forces attempting to attack or penetrate the friendly air environment” (2001, I-2). Given this definition it is logical to assume that each service conducting the DCA mission must possess some sort of capability to perform the tasks of detecting, identifying, intercepting, and destroying or negating enemy air and missile threats.

In addition to having similar capabilities, the Army and the Air Force have similar defensive counterair employment principles. In AFDD 2-1.1, *Counterair Doctrine*, the Air Force acknowledges “the object of DCA . . . is synonymous with air defense” (2002, 3). Since joint doctrine and Air Force doctrine do not specifically define defensive counterair employment principles, but do agree that DCA and air defense are the same thing, then it is logical to assume the Army’s air defense employment principles of mass, mix, mobility, and integration apply to defensive counterair and the Air Force as well. An example of proof of this logic is found in the 1995 Commission on Roles and Functions report which stated, “A review of Theater Air Defense is needed to ensure we have the appropriate mix and quantities of air and missile defense systems” (Collins 1995, 125).

Comparison Criteria

Commanders should apply four employment principles when planning defensive counterair operations. FM 44-100 defines each of the four air defense employment principles of mass, mix, mobility, and integration. The following paragraphs will define mobility, integration, mix, and mass as well as the associated subcriteria of each employment principle.

Mobility

The first employment principle, “mobility,” is “the capability to move from place to place while retaining the ability to perform the air defense mission” (FM 44-100 2000, 14). The four subcriteria of mobility are speed, the effects of terrain, the effects of weather, and sustainability.

The Oxford Desk Dictionary defines speed as, “the rapidity of mobility and the rate or progress of motion” (1995, 555). Speed in this study does not apply to strategic responsiveness, but does apply to tactical employment coordination. Although the faster a weapon system can get into the joint area of operations and employ with other forces, the quicker it can influence the battlefield, currently Patriot cannot perform the air defense mission while on a plane, train, or ship. Hence, the author will not discuss strategic responsiveness. However, DCA weapons systems require a certain amount of time to not only move from one location to another but also require time to be “ready to fire” or achieve a minimum engagement capability. The author defines minimum engagement capability as the ability to detect, track, identify, and engage with at least two missiles and have communication with an airspace control platform. The quicker a DCA system can shut down, move, and then reemploy to achieve a minimum engagement capability

the better. But who does the Patriot battery coordinate with to ensure airspace controllers are aware of and can quickly compensate for potential gaps in coverage while the unit moves?

The effect of terrain on a weapon platform is the second tenet of mobility. Some DCA weapons systems have terrain slope restrictions which limit weapon system employment. The less effect terrain has on a weapon platform the better. Effects of terrain may limit employment options, defense designs, and overall schemes of maneuver for the commander.

Just like terrain, weather can affect DCA weapon systems. Some DCA systems cannot perform their mission or must conduct degraded operations if the weather is too bad. The less effects weather has on a weapon system the better.

The final subcriterion of mobility is sustainability. The *Joint Doctrine Encyclopedia* describes sustainability as, “a measure of the ability to maintain logistic support to all users throughout the theater for the duration of the operations” (1997, 668). Sustainability of a weapons platform comes from both internal and external sources. Ultimately, all units must rely on external sources for sustainability. Therefore, the author will only discuss the external sources Patriot draws on for sustainability.

Mobility is important because it ultimately affects a commander’s ability to conduct combat operations. Terrain or weather affects the capability of all DCA weapons systems including Patriot and will not be discussed in chapter 4. More importantly, the author will analyze speed and sustainability in chapter 4 for a total of two subcriteria for mobility. Additionally, the author will also award points for speed and sustainability. Speed will be analyzed in terms of tactical employment coordination. The author will

answer the question, which service, the Army or the Air Force is in a better position to adjust air defense coverage when a Patriot battery must march order (pack up), move, emplace, and then reattain a minimum engagement capability? Based on analysis the author will award the service which answers this question with more points because the sooner Patriot can relocate and achieve a minimum engagement capability the quicker the system can influence the battle space for the commander. Lastly, the author will analyze sustainability to answer the question which service, the Army or the Air Force can best sustain the Patriot system. Based on analysis the author will award the service which answers this question with more points because sustainment enables any weapon system to continually influence effects on the battlefield for the commander.

Integration

The second and probably most important employment principle is integration. Integration is what ties the four employment principles together. “Integration” is, “the close coordination of effort and unity of action, which maximizes operational effectiveness” (FM 4-100 2000, 4-21). The two subcriteria of integration are airspace control (methods and lexicon) and joint training. The author will award points for both airspace control and joint training for the employment principle of integration.

JP 1-02 defines airspace control as, “a process used to increase combat effectiveness by promoting the safe, efficient, and flexible use of the airspace” (2002, 20). JP 3-52, *Doctrine for Joint Airspace Control in the Combat Zone*, states, “Airspace control includes coordinating, integrating, and regulating airspace to increase operational effectiveness” (V). FM 44-100 defines integration as, “the close coordination of effort and unity of action, which maximizes operational effectiveness” (2000, 4-21). Integration

infers interoperability and applies to all defensive counterair operations regardless of established command and control relationships (FM 44-100 2000, 4-21). JP 1-02 defines interoperability as “the condition achieved among communication-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users” (2002, 223). Combining the JP definition and the air defense integration requirements, interoperability, from an air defense perspective, is the satisfactory exchange of information in near real time. Therefore, interoperability is an enabler of airspace control. But, what are the methods of airspace control? What is the relationship between identification authority and identification authority?

Communication between airspace users and airspace managers is essential if the joint force wants to achieve the primary objective of airspace control. Do words mean the same things to both Air Force and Army DCA assets? The less differences in lexicon between airspace managers and airspace users the better. If all DCA assets “speak” the same language, the risk of fratricide may be reduced. The author will not discuss lexicon in chapter 4 because differences can be solved with joint training (Phillips 2003). But which service, the Army or the Air Force, is better suited to conduct airspace control?

To fully integrate and tie all of the aspects of DCA operations together, the Army and the Air Force must conduct joint training. The author defines joint training as activities where two or more services work together to teach a specified skill by practice (JP 1-02 2002, 227; and *Oxford Desk Dictionary* 1995, 611). DCA assets and airspace controllers must practice together in joint exercises to ensure proficiency at airspace control and the defensive counter mission. The greater frequency at which a DCA asset participates in joint training, the more opportunity each service has to interact with the

other. Ultimately, the more the Army and the Air Force train, practice, and work together, the more trust and confidence soldiers and airmen will have in one another. How often do Patriot and Air Force DCA capabilities conduct joint training to practice massing effects? Who prioritizes the joint training and is the joint training realistic (do we practice like we play)?

Integration enables Army and Air Force DCA capabilities to fight as a joint team. Based on analysis the author will award the service better suited to conduct airspace control and joint training with more points because that service will provide greater flexibility and agility to the JFC.

Mix

The third employment principle, “mix,” is “the employment of a combination of weapon and sensor systems to protect the force and assets from the threat” (FM 44-100 2000, 4-21). The four tenets of mix are the types of DCA platforms, the number of each type of DCA platform, the purpose of each platform, and the intraservice combinations of organic DCA assets to destroy or neutralize the threat.

Both the Army and the Air Force possess multiple types of DCA platforms to engage hostile aircraft and missiles. The greater the number of different types of DCA platforms a service possesses, the greater the amount of flexibility that service provides to the JFC.

Closely tied to the different types of DCA platforms is the number of weapon systems within each type of platform to perform the DCA mission. For example, the Army owns the Patriot missile system. Patriot is a type of DCA platform. The Army currently has fifty active Patriot batteries, ten are PAC3 capable and forty are PAC2

capable. PAC2 and PAC3 Patriot batteries consist of one radar and eight launchers per battery. A PAC2 battery launcher can only hold four missiles, while a PAC3 battery launcher can hold sixteen missiles. So, the number of Patriot weapon systems is 50 but of those 50 batteries, 10 systems have the ability to fire 108 missiles (16 missiles per launcher x 8 launchers = 108 missiles), while 40 batteries have the ability to fire 32 missiles (4 missiles per launcher x 8 launchers = 32 missiles).

In addition to types and numbers of DCA platforms, the purpose of the platform affects how a commander may mix DCA assets. The Army and the Air Force classify platforms as either single or dual use. An example of a dual use platform would be the Navy's F/A-18. The "F" indicates "fighter" for use as a DCA platform and "A" indicates attack for use as an offensive counterair platform. Therefore, since the F/A-18 is used for both DCA and OCA it is a dual use platform (Naisbitt 2002). Platforms dedicated solely for the purpose of defensive counterair are better than platforms that have a dual use. The commander may re-role DCA platforms for offensive counterair missions potentially not leaving himself with enough platforms to accomplish the DCA mission or placing an extreme resource burden on another DCA platform. Although the different types of platforms, the purposes of platform, and the different numbers of weapons systems within a platform are important, the real question is, which service the Army or the Air Force is better suited to plan for and execute the Air Defense Plan with Patriot? Based on the analysis the author will award points more points for mix to the service who can best answer this question.

By applying the principle of mix, commanders may preclude duplicating efforts and offset the limitations of one defensive counterair system with the capabilities of

another. Properly applied, the principle of mix may cause the enemy to adjust its tactics and potentially become vulnerable to another friendly capability.

Mass

“Mass” is “the concentration of air and missile defense combat power” (FM 44-100, 2000, 4-21). Mass is “achieved by assigning enough firepower to successfully defend the force or protect the asset against air and missile attack or surveillance” (FM 44-100 2000, 4-21). Massing effects does not necessarily mean a massing of forces. Instead of massing forces to support decisive operations, FM 3-0 states the US military will leverage technology to mass *effects* on the battlefield (2001, 3-4). The four subcriteria used to evaluate mass are detection range, intercept range, intercept altitude, and type of defense.

According to the definition of defensive counterair, a DCA asset must have the ability to detect incoming threats. Since the DCA mission is purely reactive, the farther out a threat is detected the more time DCA assets have to react. Between current satellite capabilities, the large ground radars located at control reporting centers (CRC) and airborne warning and control systems (AWACS) early warning will give the Patriot early warning of aerial threats. Again, since DCA is reactive in nature, the sooner and farther out detection occurs the more time Patriot has to respond to the threat. Therefore, the better and faster the interoperability between Patriot and these early warning platforms the earlier Patriot operators can be apprised of the threat.

The third task listed in the definition of DCA states a DCA asset must also have the ability to intercept a threat (JP 3-01.3 2001, I-2). Again, since DCA is purely reactive in nature, the greater the distance in range and the greater the altitude an intercept can

occur the better. The farther out and higher up an intercept occurs away from friendly troops the less fallout will affect US forces. The author will not discuss intercept altitude as it applies to tactical ballistic missiles because the Army is the only service that possesses a terminal defense missile system.

The last criterion of mass relates to the type of defense a DCA asset may perform: area defense or point defense. Simply stated assets conducting an area defense usually protect large areas of space while point defense assets usually protect a specific asset. The ability to defend a larger area with fewer assets is more favorable than protecting the same amount of space with more assets or a smaller area of space with a large number of assets. The ability to conduct an area defense and adequately protect the battle space associated with it enables a greater number of DCA assets to provide freedom from attack and freedom to attack for a larger area. Since soldiers can deploy the Patriot system in either a point defense (focused primarily on the missile threat) or an area defense (focused primarily on the aircraft threat) role, the author will not discuss this subcriterion in chapter 4. Detection range, intercept range, and intercept altitude indicate a location where DCA forces can mass combat power. So, where do DCA platforms mass combat power? Which service, the Army or the Air Force, is better suited to mass the effects of the Patriot system? Based on analysis the author will award more points for mass to the service better suited to mass effects of the Patriot system.

Study Bias

As an Army Air Defense Artillery officer with over ten years of Patriot experience at the tactical level, the author is biased on this topic. On the one hand, the author has in-depth firsthand knowledge of how the Patriot operates with the theater air

ground system and has participated in many joint training exercises and real-world contingencies. On the other hand, the author is predisposed to applying the Army frame of reference to defensive counterair operations. Aware of personal bias, the author will attempt to be fair and use both Army and Air Force objective and subjective sources to analyze data.

Conclusion

In conclusion, the four air defense employment principles of mobility, integration, mix, and mass are closely tied together. A DCA platform's mobility and integration ability influences how a commander may mix DCA assets within the joint theater of operations to mass effects on the battlefield.

In the following chapter, the author will analyze and compare the how the Army and the Air Force employ the four air defense employment principles of mass, mix, mobility, and integration pertaining to the Patriot missile system at the tactical level of warfare within the Theater Air Ground System during joint training and real world operations. The analysis will yield information where upon the author will assign points to the conclusion, and then apply the points to complete the decision matrix (table 1). The author will use Patriot to compare the six DCA employment principle subcriteria to the Army and the Air Force and then total the points in the matrix.

Table 1. Decision Matrix without Analysis

PATRIOT Employment Principles	ARMY	AIR FORCE
Mobility • Coordination		
• Sustainability		
Integration • Airspace Control		
• Joint Training		
Mix • Plan and Execute Air Defense Plan		
Mass • Mass Effects		
TOTAL *more is better		

Using the total number of accumulated points in the decision matrix, chapter 5 will provide specific conclusions and recommendations as to whether the Army or Air Force is better suited to exploit Patriot for the JFC.

CHAPTER 4

ANALYSIS

In chapter 3 the author identified the constant comparative method of qualitative analysis to determine which service the Army or the Air Force is better suited to exploit Patriot for the JFC. Chapter 4 will analyze and compare the Patriot system to the Army and then the Air Force using a total of six subcriteria described in chapter 3: two subcriteria of mobility, two subcriteria of integration, one subcriterion of mix, and one subcriterion of mass. Ultimately, based on the analysis in this chapter, the author will award points for each of the subcriterion and put the results into the previously discussed decision matrix to determine conclusions and make recommendations in chapter 5.

Mobility

To recall, the author defined the DCA employment principle mobility as, “the capability to move from place to place while retaining the ability to perform the air defense mission” (FM 44-100 2000, 21). The two most important subcriteria identified in support of mobility were speed of coordination and sustainment.

Speed, “the rapidity of mobility and the rate or progress of motion” applies to tactical employment coordination (*Oxford Desk Dictionary* 1995, 555). The faster a Patriot unit can shut down, move, and then reestablish a minimum engagement capability, the sooner the weapon system can mass effects for the commander. Determining the new location of and moving Patriot batteries to perform the defensive counterair mission is challenging and resembles putting a puzzle together. The JFC always has the requirement to defend more assets than the resources he has to protect

those assets (Karbler 2003). For this reason, the JFC publishes a defended asset list which is merely a prioritized list of assets the JFC wants defended against air and missile attack (Locke 2002). The JFC may change the priorities on the defended asset list based on different phases of the campaign plan (Karbler 2003). So, during defensive counterair operations at the tactical level who does the Patriot battery coordinate with to ensure airspace control platforms are aware of and can quickly compensate for potential gaps in coverage while the unit moves?

The Patriot battery Engagement Control Station (ECS) is a shelter on a five-ton truck where the fire control crew “fights the air battle,” detecting, identifying, intercepting, and destroying or negating all hostile air and missile threats. The Massachusetts-based defense contractor Raytheon designed the Patriot system to fight as a battalion, one airspace control manager for six firing batteries (Simmons 2003). The Patriot battalion airspace control shelter is called the Information and Coordination Central (ICC) (FM 3-01.85 2002, 3-5). Unlike the firing batteries the ICC does “not” have organic radar or launchers with missiles. The ICC does, however, provide interoperability to other joint airspace control capabilities. In essence, the ICC is Patriot’s link into the joint world (Simmons 2003).

The Patriot ICC is usually under the tactical control of an Air Force Airborne Warning and Control System (AWACS) or control-reporting center (CRC) (Phillips 2003). The ICC interfaces with AWACS via a tactical digital interface link (TADIL) called TADIL J and with the CRC via TADIL B (FM 3-01.85 2002, C20). To interface with the batteries, however, the ICC uses a link called PADIL (Patriot Digital Interface

Link). PADIL is unique to Patriot and is currently the only digital language the ECS can use at the battery level (Karbler 2003).

When a Patriot battery needs to relocate, the operators inside the ECS must contact the ICC and ask for permission to drop their radar coverage and move. At this time the ICC normally directs other Patriot batteries in the battalion to change their state of readiness of their state of emission to compensate for gaps in coverage the moving unit created (Phillips 2003). Rarely, does the ICC inform the AWACS of any battery moves. The Air Force does not control the physical positioning of Patriot batteries; the Army does (Locke 2002; and Karbler 2003). But why does the Army and not the Air Force control the physical positioning of Patriot batteries?

The answer stems from roles and missions, service visions translated into doctrine, and the threat. As stated in chapter 1, all four services have the responsibility for theater air and missile defense (Collins 1995, 11-13). Independently, each service translated its vision into effective counterair doctrine, but “joint counterair doctrine accommodates competing service concepts instead of melding them into a coherent whole” (Holmes 1995, 14). For example, even though the JFACC/ACA/AADC is an Air Force general one of his deputies, usually the Deputy Area Air Defense Commander (DAADC), is an Army air defense general officer (usually the Commanding General of the Army Air and Missile Defense Command) (Karbler 2003). The DAADC, representing the JFLCC (usually an Army or Marine general officer) priorities, makes recommendations to the AADC about Patriot coverage, but the AADC seldom rebuts the DAADC’s recommendation (AAMDC 2002, 3: and Locke 2002). Oversimplified, this example could be viewed as the Air Force comfortable with its span of control will deal

with all the assets in the air and the Army will deal with all the assets on the ground. Rarely, if ever, does the AADC consider using Patriot to combat the fixed wing and rotary wing threat (Locke and Naisbitt 2002). Instead, because of the missile threat, the Army, with the only antitactical ballistic missile capability in the joint force, is relegated to strictly TBM defense. Whether it is because of joint doctrinal structure, span of control, the limited fixed wing and rotary wing threat coupled with a significant missile threat or a lack of trust and confidence between the services, responsibility for different threats seems to have become stovepiped at the operational level. Stovepiping responsibility at the operational level transcends into a division of labor at the tactical level where Air Force AWACS crews are primarily focused on combating the air threat and preventing fratricide while the Army ICC is primarily focused on the missile threat.

The second subcriterion of mobility is sustainability. Sustainability is applicable because “the weapons delivery component of a counterair system includes weapons, the systems that deliver them, and the resources required to support them” (Holmes 1995, 19). To recall, the *Joint Doctrine Encyclopedia* describes sustainability as, “a measure of the ability to maintain logistic support to all users throughout the theater for the duration of the operations” (1997, 668). JP 1-02 defines logistics as, “the science of planning and carrying out the movement and maintenance of forces” (2002, 256). JP 1-02 defines maintenance as, “all action taken to retain materiel in a serviceable condition or to restore it to serviceability” (2002, 260). Regardless of which service “owned” Patriot that service would have the required military occupational specialties, equipment, and supplies to conduct maintenance on the Patriot missile system. Given this fact, it is prudent to explore the nature of the environment in which the Army and the Air Force conduct

maintenance. Again, regardless of ownership given a well-built-up infrastructure either service could adequately provide maintenance for a Patriot unit. But is there a requirement to provide maintenance under austere conditions, and if so, which service is the best to do that?

Patriot units are currently organized to support either Army corps or echelon above corps units. Echelon above corps units are theater assets and are normally assigned to protect such critical assets as air points of debarkation and sea points of debarkation. Echelon above corps Patriot units assigned the protection of points of debarkation are usually static. Since the infrastructure at major points of debarkation are usually well resourced, and built-up maintenance is not as challenging for Patriot units assigned to support the corps (Garrett 2003). Patriot units required to support the corps are required to move as the corps moves to protect key assets, such as command and control nodes, forward air-refueling points, and different classes of supply points (such as ammunition and fuel) (Karbler 2003). As the corps moves farther away from the point of debarkation, the environment usually becomes more austere (Karbler 2003). The Army, because of its mission, is designed to conduct maintenance as its forces progress over land. The maintenance teams move along with the land force. The Air Force on the other hand is not organized to move its maintenance as the force moves. For example, the Air Force cannot stop an F-15 or AWACS in midflight to call out a maintenance team to fix an aircraft while it is in midair. The F-15 or AWACS crew must fly that aircraft to a base to get it to a maintenance team to fix the aircraft.

Integration

As previously stated in chapter 3, FM 44-100 defines integration as, “the close coordination of effort and unity of action, which maximizes operational effectiveness” (4-21). The two subcriteria of integration are airspace control and joint training.

JP 3-52 states, “Airspace control includes coordinating, integrating, and regulating airspace to increase operational effectiveness” (1995, V). The primary objective of airspace control is, “to maximize the effectiveness of combat operations without adding undue restrictions and with minimal adverse impact on capabilities of and Service or functional component” (JP 3-52 1995, V). To achieve the primary objective of airspace control the Air Force uses centralized control and decentralized execution (TAGS 1998, III-4). The Army Air Defense community agrees. FM 44-100, *US Army Air and Missile Defense Operations*, states, “Centralized control with decentralized execution permits the full exploitation of the combat effectiveness of air defense operations at each level of command” (2000, 5-20; and JP 3-52 1995, II-4). So, what methods does the joint force use to centralize control and decentralize execution while coordinating, integrating, and regulating the airspace? More importantly which service, the Army or the Air Force, is better suited to conduct airspace control?

Airspace controllers use positive and procedural methods stipulated in the AADC’s *Air Defense Plan* and executed via the Air Tasking Order and Airspace Control Order to prioritize, coordinate, and deconflict the use of airspace (JP 3-52 1995, III-3; and 4). Positive airspace control, “positively identifies tracks and directs air assets using radars and other sensors, identification friend or foe, digital data links, as well as other elements of the command, control, communications, and computer systems” (JP 3-52

1995, III-5; and FM 3-52 2002,1-6). Procedural airspace control, “relies on previously agreed to and promulgated airspace control measures as: comprehensive air defense identification procedures and rules of engagement, low-level transit routes, minimum risk routes, aircraft identification maneuvers, fire support coordination measures, and coordinating altitudes” (JP 3-52 1995, III-5 and FM 3-52 2002,1-6). Positive control methods are better than procedural control methods because they identify aircraft with more certainty. Inherent in the positive and procedural methods of airspace control are proper identification and correct engagements. Since all DCA weapons systems have the organic capability to identify and engage targets, who ultimately declares the identification of a track (identification authority) and who gives the authorization to engage (engagement authority)?

Airspace control and air and missile defense engagements operations are coordinated through the principle of air battle management. The goal of air battle management is, “to control the engagement of air targets, ensuring the destruction of enemy aircraft and missiles while preventing fratricide and unnecessary multiple engagements” (FM 44-100 2000, 5-20). “Air battle management must be centralized at the highest possible level to ensure synchronization of effort and combat power” (FM 3-01.85 2002, 5-20). Usually, the highest level of centralized control for Patriot within the tactical level of warfare is either an AWACS or a CRC. So, for Patriot the identification authority and engagement authority is usually either an AWACS or a CRC. The AWACS is an airborne airspace control platform with radar that searches 360 degrees and ranges approximately 250 miles (Naisbitt 2002). Mobile, not restricted by terrain, AWACS crews have the capability to detect hostile aircraft and coordinate friendly aircraft over a

larger area and at a greater range than a Patriot radar. The Patriot radar can only search for ninety degrees, and its range is limited by terrain. The CRC performs airspace control using a very large and very powerful ground-based radar that makes the Patriot radar look pale in comparison. Most CRCs are not mobile but are located at Air Force airbases around the world (Naisbitt 2002). The Air Force mans, trains, equips, and fields everything associated with AWACS and CRCs. Besides, “Patriot units can expect the JFACC/AADC (usually an Air Force general) to exercise tight centralized control of Patriot firepower to prohibit fratricide” (FM 3-01.85 2002, 5-21). But is airspace control something that can be easily executed without joint training?

Air Force and Army DCA weapons systems and airspace control elements must practice together either in joint exercises to ensure proficiency at air battle management and defensive counterair operations. But is joint training truly joint, or do services call exercises joint when in actuality the exercise is not? To recall from chapter 3, the author defined joint training as activities where two or more services work together to teach a specified skill by practice (JP 1-02 2002, 227; and Oxford 1995, 611). Joint Forces Command is responsible for the majority of all joint training exercises within the continental US with a few exceptions. Outside of the US, the combatant commander of a particular area of operations is responsible for joint training. Examples of DCA training exercises and evaluations deemed as “joint” include the Joint Combat Identification Evaluation and Testing (JCIET), Roving Sands, North Atlantic Treaty Organization Tactical Evaluations (NATO TAC EVALs), and Green Flag. Using these examples where the Air Force and the Army must work together, responsibility for each exercise is a different proponent. Joint Forces Command is responsible for setting the priorities and

conducting the training for the Joint Combat Identification Evaluation and Test (JCIET) exercise (JCIET 2001, 3). The Army Air and Missile Defense Command sets the priorities and training objectives for roving sands (Locke 2002). AIRCENT, or Air Forces Central Europe responsible to the Commander in Chief United States Army Europe, sets the priorities, training objectives, and the evaluation standards for all NATO TAC EVALs. The Air Force sets the priorities and training objectives for GREEN FLAG (Naisbitt 2002).

Even though Green Flag, NATO TAC EVALs, JCIET, and ROVING SANDS present the opportunity for the Army and the Air Force to conduct joint training where Patriot, AWACS, and F-15s work together, JCEIT and Roving Sands seem to be two of the few exercises where joint training with all three DCA assets actually occurs. Green Flag is an Air Force run exercise held at Nellis Air Force Base, Nevada. Described as a “large-force employment” exercise that pits fighters, bombers, and support aircraft against an equally large or larger opposing force the focus of this exercise is offensive counterair operations (Nahom 2001, 62). The DCA training that does occur “normally does not include Patriot” (Nahom, 2001, 62). NATO TAC EVALs held exclusively in Europe involve mostly American, German, and Dutch air defense units. Patriot units are evaluated at the battery, battalion, and brigade level but are not required to interface with the Air Force in anyway even though airspace control plans for the region include Air Force assets. Unlike the Air Force only exercise Green Flag and the Army only NATO TAC EVALs, JCEIT and Roving Sands are truly joint in nature. JCIET, held at Gulfport, Mississippi, primarily uses a live, single-integrated air picture and common operational picture to execute DCA operations. Roving Sands held at Fort Bliss, Texas primarily uses

a simulated large-scale, single-integrated air picture to conduct DCA operations (JCIET 2001, 5). Both JCIET and Roving Sands “exercise the JTF headquarters and provide it with realistic full spectrum combat operations training at the joint and combined level” and utilize a “fight, learn (through after action reviews) fight” approach to training (JCIET 2001, 2 and 5). But how often do Army and Air Force DCA assets get to participate in JCIET and Roving Sands? Sadly, both of these large exercises occur only over a month’s long period once every two years because of funding constraints, coordination requirements, and the operational tempo of Patriot units, F-15s, and AWACS crews (JCIET 2001, 8-10). To practice massing DCA effects only two out of every 24 months does not lend itself to crew proficiency. What is even worse, Joint Forces Command is making a proposal to combine 2003’s exercise with Roving Sands. If JCIET and Roving Sands combine then Army and Air Force DCA forces will only get to train jointly practicing the massing of effects once every twenty-four months. On the other hand, over in other parts of the world such as Southwest Asia, F-15s, AWACS, and Patriot units have been conducting Operation Southern Watch for the past twelve years.

Mix

Chapter 3 described mix as, “the employment of a combination of weapon and sensor systems to protect the force and assets from the threat” (FM 44-100 2000, 4-21). “A counterair force that fails to achieve an appropriate balance between air and surface elements or offensive and defensive efforts will limit the JFC’s strategic options” (Holmes 1995, v-vi). But given the different types, purposes of platforms, and the different numbers of weapons systems within a platform, the real question is, Which

service, the Army or the Air Force, is better suited to plan for and execute the Air Defense Plan with Patriot?

In 2020, the Army and the Air Force will have a plethora of DCA weapons systems on the battlefield. Specifically, the Army will have Patriot, Medium Extended Air Defense System (MEADS--a Patriot like system but with a 360-degree radar) and theater high-altitude air defense (THAAD--capable of engaging aerial objects in the exo-atmosphere) (Locke 2002). All three of these Army capabilities are still considered terminal defense weapon systems. Because of the proliferation of ballistic and cruise missiles, the Army's DCA weapons systems will continue to primarily focus on missile defense.

The Air Force will have the F-15, the F-22 (the F-15s replacement but is now a dual-purpose aircraft), and the Airborne Laser (*Air Force Posture Statement 2000* 1999, 60-65). The F-22 is not just an air-to-air DCA platform, but also an offensive counterair platform. The Airborne Laser is a fixed wing aircraft with a large laser mounted in it. The Air Force designed the Airborne Laser to intercept TBMs in the boost and midcourse phase (the two phases prior to the terminal phase) of enemy missile flight (Lussier 2002, 29).

For airspace control assets the Air Force will still have AWACs and the CRC (*Air Force Posture Statement 2000* 1999, 52-58). Army Patriot units will still have an ICC, and THAAD units will have Engagement Operation Shelters (Simmons 2003; and Lussier 2002, 28-30). The Army Air Defense community will also field Patriot units with a Battery Command Post that will have a 2M terminal. The 2M terminal will make

TADIL J accessible from AWACS at the battery level and may or may not eliminate the need for a Patriot ICC (Karbler 2003).

Currently the JFC designates a service component commander as the JFACC based on “the preponderance of [air] assets to be used” and the ability to assume that responsibility (TAGS 1998, 21). Since the Army is primarily concerned with putting boots on the ground, the Navy is primarily concerned with ships, and the Air Force is primarily concerned with aircraft, the JFACC, except in rare instances, will always be an Air Force general officer. Unless doctrine changes, the JFACC, who is also normally the ACA, and the AADC will be in charge of the Air Defense Plan. In short, the Air Force will be responsible for putting together the Air Defense Plan.

Mass

Chapter 3 defined mass as, “the concentration of air and missile defense combat power” (FM 44-100 2000, 4-21). Current doctrine has gone away from talking about massing forces to leveraging technology to mass effects (FM 3-0, 3-4). But how exactly do joint DCA forces mass effects?

Friendly air, land, and maritime DCA assets must conduct fully coordinated and seamless operations to maximize enemy air and missile engagements, limit the number of multiple engagements at a single target, and minimize fratricide (JP 3-52 1995, III-5). Airspace control and hostile aerial engagements are inextricably linked in defensive counterair operations. Because of this link, airspace control must be a part of defensive counterair operations (FM 3-52 1995, 4-8). It is airspace control that ensures fully coordinated and seamless operations. As previously mentioned, the ACA (usually the same person as the AADC and JFACC) develops an airspace control plan which contains

both positive and procedural control methods (FM 3-52 1995, 4-8). Procedural methods include airspace control measures (JP 3-52 1995, III-5). Airspace control measures are, “rules, mechanisms, and directions governed by joint doctrine and defined in the airspace control plan” (FM 3-52 2002, 4-2). Airspace control measures define specific dimensions of the airspace to accomplish one or more of the following functions:

- a. Establish reserved airspace for specific airspace users
- b. Restrict the actions of some airspace users
- c. Create airspace in which units can use weapons with minimal risk of fratricide
- d. Control actions of specific airspace users
- e. Require airspace users to accomplish specific actions (FM 3-52 2002, 4-2)

A weapons engagement zone is an airspace control measure where defensive counterair assets mass effects to engage hostile air and missile threats (TAGS 1998, A-5).

A weapons engagement zone is, “airspace of defined dimensions where the responsibility for the engagement normally rests with a particular weapon system” (TAGS 1998, A-5).

Examples of three of the most common weapon engagement zones are fighter engagement zones, missile engagement zones, and joint engagement zones.

A fighter engagement zone is “airspace of defined dimensions where the responsibility for engagement normally rests with fighter aircraft” (TAGS 1998, A-5).

Fighter engagement zone operations “take place in airspace above and beyond the engagement ranges of surface based (land and sea) air defense systems” (JP 3-52 1995, III-6).

A missile engagement zone is, “airspace of defined dimensions where responsibility for engagement normally rests with surface to air missile weapons systems” (TAGS 1998, A-5). Missile engagement zone operations are “ideal for point

defense of critical assets, protection of maneuver units in the forward area, and area coverage of rear operations” (JP 3-52 1995, III-6).

A joint engagement zone (JEZ) is where, “multiple air defense weapon systems of one or more service components, simultaneously and in concert, engage enemy airpower in the same airspace” (JP 3-52 1995, III-6). Because JEZ zone operations allow for air-to-air and surface-to-air engagements in the same airspace, effective command and control is imperative. Without it, JEZ zone operations are “extremely difficult to implement” (JP 3-52 1995, III-6).

If weapon engagement zones are how DCA weapons systems, which service, the Army or the Air Force, is best suited to mass effects for the Patriot missile system? Earlier it was determined the ACA, normally an Air Force general officer was responsible for the Airspace Control Plan which contained positive and procedural airspace control methods. Positive and procedural methods ensure proper identification of all aerial objects, deconflict the use of airspace, and enable the engagement of hostile aerial threats while minimizing fratricide. “Rapid, reliable, and secure means of identification are critical to the effectiveness of air defense as well as to the survival of friendly aircraft” (FM 44-100 2000, 3-13). Identification authority or the level of airspace control where the identity of a track is determined and engagement authority or the level of airspace control that authorizes an engagement are closely tied together. Engagement authority cannot be delegated below identification authority. DCA weapon systems cannot engage a track if it has not been identified. To minimize fratricide, the ACA centrally controls the identification authority and engagement authority at high levels. For

Patriot operating in a joint environment, the identification authority and the engagement authority is usually an AWACS or a CRC.

Conclusion

Chapter 4 analyzed the four air deployment principles of mobility, integration, mix, and mass as well as their subcriteria. Chapter 5 will state conclusions drawn from the analysis done in chapter 4 and make further recommendations for study.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

In the previous chapter, the author analyzed and compared the Patriot system to the Army and the Air Force using DCA employment principles. What follows is a conclusion, summed up at the end of the chapter in a decision matrix (more points are better), as to which service the Army or the Air Force is better suited to exploit the Patriot missile system for the JFC. Also included in this chapter are recommendations for further study on the issue of theater air and missile defense.

Mobility

The author defined the DCA employment principle mobility as, “the capability to move from place to place while retaining the ability to perform the air defense mission” (FM 44-100 2000, 4-21). The two most important subcriteria identified in support of mobility were speed of coordination and sustainment. With respect to speed of coordination, three major factors impact on which service is better suited to coordinate DCA operations for Patriot: the joint doctrinal structure of the JFACC and the DAADC, the positioning authority, and a single capability to destroy or neutralize missile threats after launch (i.e., Patriot). The DAADC represents the JFLCC’s priorities, not the JFACC’s, and also has the authority to decide where on the ground Patriot units position themselves to destroy or neutralize an airborne missile threat. Stovepiping responsibility for specific threats at the operational level or warfare transcends into service specific execution at the tactical level of warfare. As an example in DCA operations, an Air Force AWACS crew designates fighters to combat the fixed wing and rotary wing threat, but

relies solely on the ICC to manage Patriot units that combat the missile threat. Until stovepiping responsibility for specific air and missile threats stops being the norm, the Army is best suited to integrate Patriot into the DCA mission. With respect to sustainability both the Army and the Air Force can probably maintain the Patriot system given a built-up infrastructure but the Army is better suited to sustain Patriot when it must move with land forces under more austere conditions. Therefore, the Army scores two points to the Air Force's one point for speed in coordination, and another two points to the Air Force's one point for sustainability. In conclusion the Army scores four points to the Air Forces two in the category of mobility.

Integration

The author defined integration as, "the close coordination of effort and unity of action, which maximizes operational effectiveness" (FM 44-100 2000, 4-21). The two subcriteria of integration were airspace control and joint training.

Airspace control utilizes positive and procedural methods to coordinate, integrate, and regulate the airspace without significantly impacting or adding undue restrictions on a specific service. Because members of the Air Force normally develop the Airspace Control Plan, have primary responsibility for the Air Tasking Order (executed in the form of an Airspace Control Order), and train and equip the majority of airspace control platforms that conduct air battle management for both air and ground DCA capabilities, the Air Force is the best service suited to conduct airspace control for the Patriot system. As such, the Air Force is awarded two points to the Army's one point.

How well Army and Air Force DCA forces integrate with one another is directly proportional to the frequency and quality of joint training. Unfortunately, training

happens more frequently within a service than it does between two services. When Army and Air Force DCA assets do conduct joint training, they train as they fight but in an extremely controlled environment, and the frequency of training outside of real world operations is inadequate to maintain defensive counterair skill proficiency. Fortunately, infrequent joint training exercises are currently offset by real world operations, such as Southern Watch in Southwest Asia. Ultimately, if the Army and the Air Force do not have a long period of time to work together before executing operations in a wartime environment, the risk of fratricide greatly increases.

If Patriot were part of the Air Force, it is possible that air-to-air and surface-to-air DCA capabilities would get to conduct more training. The more training units get to do with one another the more trust and confidence soldiers and airmen will have in one another. The more trust and confidence airmen and soldiers have in one another the more likely JEZ operations are to become a reality. Since neither the Army nor the Air Force does a particularly good job at conducting frequent joint training, both services receive one point for the subcriterion of joint training. In conclusion, the Air Force receives three points to the Army's two points for the employment principle of integration.

Mix

The author described mix as, "the employment of a combination of weapon and sensor systems to protect the force and assets from the threat" (FM 44-100 2000, 4-21). In 2020 the Army and the Air Force will have a multitude of DCA capabilities. The Army will have Patriot, MEADS, and THAAD; and the Air Force will have the F-15, the F-22, and the airborne laser. More important than weapon platform type, weapons system numbers, or platform purpose is how to mass effects to ultimately achieve air superiority.

Because the JFC understands control of the air is a critical enabler to successful campaigns, counterair operations consist of offensive counterair and defensive counterair, and the Air Force's mission is to "defend the nation through the control and exploitation of air and space," the Air Force will always have the largest majority of forces committed to achieving air superiority (JP 3-33 1999, vi-vii). Since the Air Force will usually have the preponderance of forces committed to achieving air superiority, the JFC will designate an Air Force general as the JFACC. Additionally, the majority of the airspace control assets belongs to the Air Force, and other service DCA assets are usually under the tactical control of an Air Force airspace control asset. Common sense might lead to the conclusion that the Air Force is better suited to integrate, plan for, and execute Patriot operations as part of the Air Defense Plan. But, until changes are made to current doctrine that solves the problem of stovepiping operations at the operational level, the span of control one AWACS crew can handle increases, or the Air Force takes Patriot over from the Army, the Army is the best service to integrate, plan for, and execute Patriot operations as part of the Air Defense Plan. In conclusion, the Army receives two points to the Air Force's one point for the employment principle of mix.

Mass

The author defined mass as, "the concentration of air and missile defense combat power" (FM 44-100 2000, 4-21). But since current doctrine has gone away from talking about massing forces to massing effects, the author essentially substituted the word "combat power" with "effects." DCA weapons systems mass effects in engagement zones, such as missile engagement zones, fighter engagement zones, and joint engagement zones. All engagement zones are procedural controls articulated in the air

defense plan, executed via the airspace control order. Surface-to-air missile platforms use missile engagement zones to mass effects. Air-to-air platforms use fighter engagement zones to mass effects. But a joint engagement zone (JEZ) is not mutually exclusive.

Defensive counterair assets operating in a seamless and fully coordinated environment can mass effects in a JEZ. Seamless and coordinated environments are dependent upon the level of integration DCA assets achieve through the use of airspace control and joint training. If Army and Air Force DCA weapons systems and airspace control assets have enough time to train together to develop trust and confidence between members of the two services and if the threat is severe enough to warrant a JEZ, JEZ operations may become a reality. Effective JEZ operations could provide adequate air defense while freeing up dual purpose fighters, like the F-22 for offensive action.

Ultimately, weapon engagement zones and the identification authority shape when, where, and how DCA weapons systems will mass effects. Patriot engages hostile aerial threats in missile engagement zones dictated in an Air Force Airspace Control Order and is controlled by an Air Force identification authority, namely AWACS or a CRC. Since the Air Force is primarily responsible for the planning and execution of engagement zones and identification of hostile threats, the Air Force is the better service suited to mass effects for the Patriot missile system. Therefore, the Air Force receives two points to the Army's one point for the employment principle of mass.

Conclusion

The author discovered through analysis the three reoccurring themes of airspace control, positioning authority, and training. The Army does a better job coordinating Patriot with the Air Force, but the Air Force is better suited to conduct airspace control

for “all” airspace users. With Patriot units under the tactical control of the Air Force, having only one Patriot ICC to coordinate up to six Patriot units on the ground, significantly reduces to manageable levels the AWACS or CRC span of control. Joint training exercises are not conducted frequently enough unless real-world contingencies, like Southern Watch, are included in the category of exercises. Time working together, either in exercise or in real-world missions, seems to have a relationship to fratricide. The more time the Army and the Air Force have to work together to practice tactics, techniques, and procedures, the less likely fratricide is to occur.

The summary of points for each employment principle is listed in table 2.

Table 2. Decision Matrix Conclusions

PATRIOT Employment Principles	ARMY	AIR FORCE
Mobility • Coordination	2	1
• Sustainability	2	1
Integration • Airspace Control	1	2
• Joint Training	1	1
Mix • Plan and Execute Air Defense Plan	2	1
Mass • Mass Effects	1	2
TOTAL * more is better	9	8

Tallying the points from all four DCA employment criteria guidelines the Army scored nine points to the Air Force’s eight. In this decision matrix since more points are

better than less points, the author concludes the Army is better suited to efficiently and effectively exploit the Patriot missile system for the JFC. If the author had weighted integration in the decision matrix, however, the conclusions might have come out differently. Ultimately, the point tally was so close that continued joint control is the optimum solution.

Recommendations

Throughout the course of this study the author identified numerous recommendations which could potentially make DCA operations more efficient and effective for the JFC. The following paragraphs discuss the need to determine the right mix of DCA assets across the services, the need for a single integrated air picture to conduct JEZ operations, solutions to ensure seamless DCA operations, as well as topics for further study.

While doing research, the author could not find any studies that considered the right mix of DCA weapons systems across the Army, the Navy, the Air Force, and the Marines. The author encountered many studies strictly related to a particular service. For example, the Army conducted a study to determine how many Patriot units it needed, the Air Force conducted a study to determine how many F-22s it needed, and the Navy did a study to determine how many Aegis cruisers it needed, but no one has conducted a study to determine how many Patriot, F-22, and Aegis cruisers the armed forces as a whole needs. The author recommends the issue of holistic DCA capabilities be studied to determine the right mix of weapon systems across the armed services.

Also, while conducting research, the author discovered that all four services, the Army, Navy, Air Force, and Marines, doctrinally advocate a joint engagement zone and

some services even conduct JEZ operations in simulations. In real life, however, the author has never experienced or ever known anyone in any service who has actually conducted JEZ operations. If JEZ operations are to become a reality, the single-integrated air picture must come to fruition, and all services must conduct joint training habitually. To practice the way the armed forces fight, someone should conduct a study to determine if the armed services should permanently reorganize into joint task forces.

Additionally, the author determined joint doctrine and the current capability to defeat the threat essentially stovepipe the Army and the Air Force in both planning and executing DCA operations. However, the more time Army and Air Force DCA assets and airspace control platforms train together prior to executing real-world operations, the more the effective and efficient DCA operations will be and the risk of fratricide will decrease. Conversely, the less time the two separate services have to train and establish DCA techniques, tactics, and procedures, the risk of fratricide greatly increases.

Airspace control and the minimization of fratricide will continue to be an issue for Joint Force Commanders well into the future. The number of airspace users for both friendly and enemy forces is greatly proliferating as the Armed Forces advance into the twenty-first century. To ensure seamless effective and efficient coordination, integration, and regulation of the airspace, the Army and the Air Force must either create a standing organization, such as a Joint Theater Missile Defense organization that works directly for the JFC or continue to execute DCA operations with a “pick up team.” To ensure the success of a nonstanding organization, however, each service might want to consider conducting more frequent live DCA joint training exercises where the training priorities are consistently set by one organization, increasing joint simulation requirements and

exercises, and formalizing the liaison process by adding joint personnel authorizations to a unit's modified table of organization and equipment. For example, the Air Force might add a Patriot officer onto an AWACS crew and a Patriot battalion might add an Air Force controller to work in the battalion fire direction center.

Lastly, the author recommends three areas for further study. First, research should be done to determine the impact the Air Force's airborne laser, designed to destroy or negate tactical ballistic missiles in the initial and boost phases of flight, will have on airspace control and how it will integrate with terminal defense systems such as Patriot, MEADS, and THAAD. Second, with advances in technology and the resultant increase in sensor fusion, weapons range, and capability, research should be done to determine which systems, like attack helicopters, long-range rockets, unmanned aerial vehicles, and electromagnetic pulse weapons, should be on the Air Tasking Order. Third, given the advances in a common operational picture, should the Air Tasking Order cycle be shortened? The author believes the answers to all three questions will significantly define not only defensive counterair operations in the future but also how the joint force will achieve air superiority.

APPENDIX A

LIST OF INTERVIEW PARTICIPANTS

1. Colonel Michael P. Locke. US Army. Chief Space, Air, and Missile Defense Division, Department of the Army Programs Force Modernization Office, Headquarters Department of the Army; Former Air Defense Artillery Chief Liaison to the Missile Defense Agency, and former Air Defense Artillery Brigade and Battalion Commander.
2. Lieutenant Daniel L. Karbler. US Army. 3rd Battalion 43rd Air Defense Artillery Brigade Battalion Command designee and former Brigade and Battalion operations officer for 108th Air Defense Artillery Brigade (which supports 18th Airborne Corps).
3. Major Robert L. Phillips. United States Army. Current CGSC student and former ICC Tactical Director with extensive experience in Kuwait and Operation Southern Watch.
4. Major Heather L. Garrett. US Army. Ordnance Officer and current CGSC student. Former Brigade S-4 for 35th Air Defense Artillery Brigade.
5. Major Charles E. McMurtrey. US Army. Current J-8 officer working for JTAMDO. Former Brigade and Battalion Operations officer for 35th Air Defense Artillery Brigade
6. Major David Naisbitt. US Air Force. Air Force weapons controller and current CGSC student. Former CRC officer in Kuwait with experience in Southern Watch.
7. Major Ralph Hansen. United States Air Force. Current CGSC instructor and A-10 pilot.
8. Mr. Thomas E. Simmons. Raytheon Engineer. Former liaison and Patriot instructor for 1st Battalion 7th Air Defense Artillery Brigade Kaiserslautern, Germany.

GLOSSARY

- Air defense. All defensive measures designed to destroy attacking enemy aircraft and missiles in the Earth's envelop of atmosphere, or to nullify or reduce the effectiveness of such attacks. Synonymous with defensive counterair.
- Air battle management. Controlling the engagement of air targets, ensuring the destruction of enemy aircraft and missiles while preventing fratricide and unnecessary multiple engagements.
- Airspace control. A process used to increase combat effectiveness by promoting the safe, efficient, and flexible use of the airspace. It includes coordinating, integrating, and regulating airspace.
- Airspace control measures. Rules, mechanisms, and directions governed by joint doctrine and defined in the airspace control plan.
- Air superiority. That degree of dominance in the air battle of one force over another which permits the conduct of operations by the former and its related land, sea, and air forces at a given time and place without prohibitive interference by the opposing force.
- Constant comparative method of qualitative research. Converting qualitative data into a crudely quantifiable form to generate a theory.
- Defensive counterair operations. All defensive measures to detect, identify, intercept, and destroy or negate enemy air and missile forces attempting to attack or penetrate the friendly air environment.
- Effective. Producing the end result. Applied to defensive counterair operations it means the integration of defensive counterair assets located in the joint area of operations into a command, control, communications, computer, intelligence, and reconnaissance network which allows for the massing of effects to destroy or neutralize multiple and various hostile airborne threats while minimizing fratricide.
- Efficient. Productive with minimum waste of effort. Applied to defensive counterair operations it means the optimal mix of mobile defensive counterair assets to detect, identify, intercept, and destroy or negate the airborne target which minimizes duplication of effort.
- Engagement authority. The level of airspace control that authorizes an engagement.
- Fighter engagement zone. Airspace of defined dimensions where the responsibility for engagement normally rests with fighter aircraft.

Functions. Assigned by the President of the US and the Secretary of Defense, amplify or supplement statutory roles.

Identification authority. The level of airspace control where the identity of a track is determined.

Integration. The close coordination of effort and unity of action, which maximizes operational effectiveness.

Interoperability. The condition achieved among communication-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users.

Joint engagement zone. Multiple air defense weapon systems of one or more service components, simultaneously and in concert, engage enemy airpower in the same airspace.

Joint training. Activities where two or more services work together to teach a specified skill by practice.

Logistics. The science of planning and carrying out the movement and maintenance of forces.

Maintenance. All action taken to retain materiel in a serviceable condition or to restore it to serviceability.

Mass. The concentration of air and missile defense effects.

Missions. Broad enduring purposes that the President or the Secretary of Defense assigns to Commanders-in-Chief of US combatant commands.

Missile engagement zone. Airspace of defined dimensions where responsibility for engagement normally rests with surface to air missile weapons systems.

Mix. The employment of a combination of weapon and sensor systems to protect the force and assets from the threat.

Mobility. The capability to move from place to place while retaining the ability to perform the air defense mission.

Offensive counterair operations. Offensive maneuvers designed to destroy, disrupt, or neutralize enemy aircraft, missiles, launch platforms, and their supporting structures and systems.

Positive airspace control. Positively identifies tracks and directs air assets using radars and other sensors, identification friend or foe, digital data links, as well as other elements of the command, control, communications, and computer systems.

Procedural airspace control. Relies on previously agreed to and promulgated airspace control measures as: comprehensive air defense identification procedures and rules of engagement, low level transit routes, minimum risk routes, aircraft identification maneuvers, fire support coordination measures, and coordinating altitudes.

Roles. Broad, enduring purposes of the US Armed Services and US Special Operations Command that Congress prescribes statutorily.

Speed. The rapidity of mobility and the rate or progress of motion.

Stovepiped. Not interoperable with another system or service. Mutually exclusive.

Supported commander. The commander who receives assistance from another commander's force or capabilities, and who is responsible for ensuring that the supporting commander understands the assistance required.

Supporting commander. The commander who aids, protects, compliments, or sustains another commander's force, and who is responsible for providing the assistance required by the supported commander.

Sustainability. A measure of the ability to maintain logistic support to all users throughout the theater for the duration of the operations.

Weapons engagement zone. Airspace of defined dimensions where the responsibility for the engagement normally rests with a particular weapon system.

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